

ADVANCED MACHINING
TOWARDS IMPROVED
MACHINABILITY OF
DIFFICULT-TO-CUT
MATERIALS

Edited by:
A.K.M. Nurul Amin (Chief Editor)
Dr. Erry Yulian Triblas Adesta
Dr. Mohammad Yeakub Ali



IIUM PRESS

INTERNATIONAL ISLAMIC UNIVERSITY MALAYSIA

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IIUM Press

Published by:
IIUM Press
International Islamic University Malaysia

First Edition, 2011
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Perpustakaan Negara Malaysia

Cataloguing-in-Publication Data

Advanced Machining Towards Improved Machinability of Difficult-To-Cut Materials: A.K.M.
Nurul Amin, Erry Yulian Triblas Adesta & Mohammad Yeakub Ali

ISBN: 978-967-418-175-8

Member of Majlis Penerbitan Ilmiah Malaysia – MAPIM
(Malaysian Scholarly Publishing Council)

Printed by :
IIUM PRINTING SDN.BHD.
No. 1, Jalan Industri Batu Caves 1/3
Taman Perindustrian Batu Caves
Batu Caves Centre Point
68100 Batu Caves
Selangor Darul Ehsan
Tel: +603-6188 1542 / 44 / 45 Fax: +603-6188 1543
EMAIL: iiumprinting@yahoo.com

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IIUM Press
International Islamic University Malaysia

First Edition, 2011
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Chapter 1

Influence of Workpiece Preheating on Chatter and Machinability of Titanium Alloy - Ti6Al4V

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1.0 INTRODUCTION

Though classified as a group of “difficult-to-cut” material, titanium and its alloys are have wide applications in the aerospace industry owing to their unique high strength-weight ratio which is maintained at elevated temperatures and their exceptional corrosion resistance. In this work, experimental investigations of the influence of preheating using induction heating on machinability of titanium alloy Ti-6Al-4V ASTM B348 were conducted. Uncoated straight grade of cemented carbide inserts were used. The cutting speed was varied in the range from 40 to 160 m/min; with varying depths of cut and feed rates. The experiments of end milling operation conducted on Vertical Machining Centre (VMC) were design to look into vibration and chatter, chip formation, tool wear and surface finish. It has been established that the machinability of the investigated titanium alloy can be enhanced in terms of lower tool wear, better surface finish, lowering of instability of chip formation and chatter, increase in chip-tool contact length, shifting of the hot spot away from the tool edge and finally lowering of the dynamic stresses acting on the tool.

Unique combinations of properties such as, high specific strength, which is maintained at elevated temperature, high fracture and corrosion resistance, have made titanium and its alloys very useful materials for aerospace and petrochemical applications. However their high cost and poor machinability are major constraints towards their wide spread applications. Ezugwu et al. [1] observed that success machining of titanium and its alloys depends largely on overcoming the problems associated with high cutting temperature and cutting pressures, small chip-tool contact length (which is about 1/3 that in the case of steel), serrated chip formation and chatter. Chatter is also undesirable because of its adverse effects on surface finish, machining accuracy and tool life [2]. Talantov and Amin [3] and Amin [4] established